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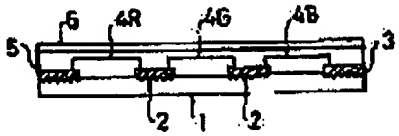
(54) COLOR FILTER FOR DISPLAY

(57)Abstract:
PURPOSE: To obtain the color filter for display which decreases the light transmittance and light reflection in inter-picture element parts without degrading brightness and color purity.
CONSTITUTION: The main parts of the color filter are constituted of a glass substrate 1, light scattering parts 2 formed by a surface roughening treatment in the inter-picture element parts of the glass substrate 1, metallic light shielding layers 3 formed on the light scattering parts 2, transparent colored layers 4R, 4G, 4B provided in the picture element parts of the glass substrate 1 and transparent electrodes 6 laminated via a smoothing layer 5. The light transmitted through the inter-picture element parts is shielded by the metallic light shielding layers 2 and the light which enters from the glass substrate 1 side and is reflected by the metallic light shielding layers 3 is scattered by the light scattering part 2 and, therefore, the intensity of the reflected light is lowered. The light scattering parts 2 are not formed in the picture element parts of the glass substrate 1, the degradation in the transmittance of the picture element parts and the degradation in the color purity arising from the development defect of the transparent colored layers 4R, 4G, 4B are prevented.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] A light filter for a display characterized by to form the light-scattering section in a part corresponding to the above-mentioned metal protection-from-light layer on a transparence substrate in a light filter for a display equipped with a transparence substrate, a transparence coloring layer which is prepared in a pixel part on this transparence substrate, and colors that transmitted light for every pixel, and a metal protection-from-light layer prepared at least for pixel Mabe on the above-mentioned transparence substrate.
[Claim 2] A light filter for a display according to claim 1 characterized by split-face--ization-processing a part corresponding to the above-mentioned metal protection-from-light layer on a transparence substrate, and forming the above-mentioned light-scattering section.
[Claim 3] A light filter for a display according to claim 1 characterized by preparing a light-scattering layer in which a particle-size submicron particle is contained in a part corresponding to the above-mentioned metal protection-from-light layer on a transparence substrate, and forming the above-mentioned light-scattering section in it.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the light filter applied to the display of a liquid crystal display etc., and relates to amelioration of the light filter which equips at least pixel Mabe with a metal protection-from-light layer especially.
[0002]
[Description of the Prior Art] This kind applied to the display of a liquid crystal display etc. of light filter is prepared in the pixel part on transparence substrates, such as glass, and this substrate, that body consists of transparence coloring layers which color that transmitted light a different color (for example, red, green, blue Kozo primary color) for every pixel, and makes display light coloring light which penetrated the above-mentioned transparence coloring layer, and displays a color picture. And the above-mentioned transparence coloring layer applies the colored photoresist on the above-mentioned transparence substrate, for example, exposes and develops it selectively, and is formed in the pixel part.
[0003] By the way, in order to prevent the color mixture of RGB accompanying the transmitted light from the crevice section between each pixel (about pixel Mabe), the protection-from-light layer is formed at least in above-mentioned pixel Mabe as the conventional light filter is indicated by JP,62-143023,A.
[0004] and although a metal thin film, photosensitive polymer, etc. are applied as a material of this protection-from-light layer, micro processing at the time of forming a protection-from-light film selectively is easy only for that the permeability of light is low, and pixel Mabe -- etc. -- the metal thin film from a reason, especially a chromium thin film are in use.
[0005] However, generally, since the reflection factor of a metal was high, when it observed a display from the above-mentioned transparence substrate side, in order that the portion of the protection-from-light layer (metal protection-from-light layer) which consists of a metal thin film might reflect a surrounding light, and contrast might be reduced and it might be dependent on an angle of visibility, it had the problem of also reducing the angle-of-visibility property of a display image.
[0006] In order to solve such a problem, the above-mentioned whole transparence substrate surface is split-face-ized, the reflected light is scattered, and the light filter which made the above-mentioned contrast and an angle-of-visibility property improve is proposed (JP,61-143791,A).
[0007]
[Problem(s) to be Solved by the Invention] However, since the whole transparence substrate surface was made to split-face-ize in such advanced technology, the permeability of a substrate was decreased, and it had the trouble that the field split-face--ization-processed reduced the brightness of the whole display also in any by the side of the light filter of a substrate, or observation.
[0008] Moreover, when the transparence coloring layer which consists of the photoresist mentioned above on the split-face-ized transparence substrate was applied, the adhesion force over the above-mentioned transparence substrate of a photoresist became large too much by split-face-ized processing, and the poor development of a greasing was caused and it had the trouble of causing lowering of color purity.
[0009] This invention was made paying attention to such a trouble, and the place made into the technical problem is to offer the light transmission which can be set at least to above-mentioned pixel Mabe, and the light filter which

decreases a light reflex, without causing lowering of brightness or color purity.
[0010]
[Means for Solving the Problem] That is, invention concerning claim 1 is characterized by to be formed the light-scattering section in the part corresponding to the above-mentioned metal protection-from-light layer on a transparence substrate on the assumption that a light filter for a display equipped with a transparence substrate, a transparence coloring layer which is prepared in a pixel part on this transparence substrate, and colors that transmitted light for every pixel, and a metal protection-from-light layer prepared at least for pixel Mabe on the above-mentioned transparence substrate.
[0011] In such technical means, at least in above-mentioned pixel Mabe, the crevice section between each pixel which constitutes a display image is meant, and fields other than the pixel section currently generally patternized in the shape of a grid are said. Moreover, the light-scattering section formed in a part corresponding to the above-mentioned metal protection-from-light layer on a transparence substrate has a function to scatter the reflected light, in case light which carried out incidence at least to above-mentioned pixel Mabe from an observer side of a display is reflected in a metal protection-from-light layer.
[0012] Here, since this light-scattering section is formed only in a metal protection-from-light layer on a transparence substrate, and a corresponding part and is not formed in a pixel part, it is different from advanced technology mentioned above, and decline in permeability in a pixel part does not take place. Therefore, in spite of forming the light-scattering section, it becomes possible to prevent lowering of the display brightness. Moreover, when a transparence coloring layer which consists of a photoresist is applied, since the light-scattering section is not formed in a pixel part of a transparence substrate, adhesion force over the above-mentioned transparence substrate of a photoresist does not increase. Therefore, since the poor development of a greasing mentioned above does not take place, it becomes possible to also prevent lowering of color purity.
[0013] About such the light-scattering section, this can be formed, or a light-scattering layer which split-face--ization-processes a part corresponding to a metal protection-from-light layer on a transparence substrate in the shape of irregularity, and changes from particle-size submicron a particle and a binder to the above-mentioned part, for example can be prepared, and this can be formed.
[0014] Invention concerning claims 2 and 3 is made based on such a technological background.
[0015] Namely, invention which both invention concerning claims 2 and 3 requires for claim 2 on the assumption that a light filter according to claim 1 Invention which is characterized by split-face--ization-processing a part corresponding to a metal protection-from-light layer on a transparence substrate, and forming the light-scattering section, and relates to claim 3 It is characterized by preparing a light-scattering layer in which a particle-size submicron particle is contained in a part corresponding to a metal protection-from-light layer on a transparence substrate, and forming the above-mentioned light-scattering section in it.
[0016] And what is necessary is just to split-face-ize selectively at least pixel Mabe who applied a photoresist on the above-mentioned transparence substrate, used a photo mask, exposed and developed negatives selectively, was made to expose at least pixel Mabe of the above-mentioned transparence substrate, and was exposed in this way, in order to split-face--ization-process selectively a part (namely, pixel Mabe grade) corresponding to a metal protection-from-light layer on a transparence substrate in invention concerning above-mentioned claim 2. In addition, wet etching or the dry etching method described below, the grinding method, etc. are applicable to this split-face-ized processing.
[0017] What is necessary is to be able to apply both a photoresist of a negative (N) type which a non-glared part dissolves in a developer and an exposure part insolubilizes to a developer as a photoresist mentioned above, and a photoresist of a positive (P) type which an optical exposure part dissolves in a developer and a non-glared part insolubilizes to a developer, and just to apply a thing corresponding to a photoresist of each type also about a photo mask.
[0018] Next, when performing the above-mentioned split-face-ized processing by the wet etching method, the following materials can be applied as the etching reagent. That is, when the above-mentioned transparence substrate consists of glass, a solvent in which fluoric acid system aqueous solutions, such as ammonium fluoride, dissolve the above-mentioned plastics, such as chloroform and an acetone, again when a transparence substrate is constituted by plastics can be applied. In addition, when split-face--ization-processing by this wet etching method, as for a processing side of a transparence substrate, it is desirable to cover with a resist film which hardened that whole surface so that a field of an opposite hand might not be corroded.

[0019] Moreover, when performing the above-mentioned split-face-ized processing by the dry etching method, for example, the reverse sputtering method etc. can be applied.
[0020] On the other hand, when performing the above-mentioned split-face-ized processing by the grinding method, a method using polishing liquid with which an abradant with a particle size of 1-2 micrometers was mixed by water, oil, etc. ten to 30% of the weight (water is efficient) can be applied. As this abradant, cerium oxide, zirconium oxide, a red oxide, chrome oxide, etc. can be used. Moreover, the sandblasting method for spraying a particle with air may be applied. As a pressure which can use a powder emery, silica sand, etc. as such a particle, and is sprayed, it is 4-7kg/cm2. It is suitable.
[0021] With next, a light-scattering layer prepared in a part corresponding to the above-mentioned metal protection-from-light layer on a transparence substrate in invention concerning claim 3 It consists of thin films of 1 micrometer or less of thickness which consists of particle-size submicron a particle and a binder, and in case light which carried out incidence at least to above-mentioned pixel Mabe from an observer side of a display is reflected in a metal protection-from-light layer, the reflected light is scattered by interface of a particle and a binder, and the reinforcement is reduced. Particle size of such a particle is smaller than thickness of the above-mentioned light-scattering layer, and its wavelength and this degree of light are desirable so that dispersion of light may be performed efficiently, and its 0.1-0.9 micrometers are especially desirable. Moreover, as a material of this particle, inorganic substances, such as the organic substance, such as resin, zirconium oxide, titanium oxide and other metallic oxides, a nitride, a fluoride, or a metal, are mentioned.
[0022] What resin, silicon oxide, other metallic oxides, a nitride, a fluoride, etc. are mentioned it is transparent and colorless and just possible [micro processing] as a material of a binder, and has photosensitivity especially on the other hand is suitable.
[0023] What is necessary is just to perform it as follows, for forming the above-mentioned light-scattering layer. First, ** is made to distribute the Ecklonia above-mentioned particle in liquid in which binder matter was dissolved. Caution is required [not choosing a solvent which also melts a particle, and] at this time.
[0024] And when a binder has photosensitivity, the above-mentioned dispersion liquid are applied on a transparence substrate by spin coat or the roll coat method. Then, if negatives are exposed and developed through a mask an object for metal protection-from-light layers or it, and reverse type, a light-scattering layer will be formed only in a substrate part in which a metal protection-from-light layer is formed. A type (a positive or negative) of the above-mentioned mask makes a type (a positive or negative) of a photosensitive material correspond, and is set up suitably.
[0025] On the other hand, when the above-mentioned binder does not have photosensitivity, binder liquid with which the above-mentioned particle was distributed was made to apply, harden or calcinate uniformly on a transparence substrate, a resist further for patterning is applied and developed [expose and] upwards, and it leaves the same pattern as a metal protection-from-light layer. After etching a binder layer by using this resist pattern as a mask, if a resist is exfoliated, a light-scattering layer of a desired pattern will be obtained. or an etching reagent of a light-scattering layer and a metal protection-from-light layer can be made to serve a double purpose again -- what is necessary is to carry out the laminating of two-layer [this], and just to perform etching processing of a metal protection-from-light layer, simultaneously a light-scattering layer, if it becomes
[0026] In addition, a binder may not be made to distribute a particle, but it may allot a part to which a particle is beforehand prepared in the whole transparence substrate surface or a metal protection-from-light layer of a substrate, and a method of applying binder liquid from on the may be taken.
[0027] Moreover, when a binder consists of a metallic oxide, a nitride, or a fluoride, the above-mentioned light-scattering layer can be formed according to dry processes, such as vacuum deposition and sputtering. namely, in forming a light-scattering layer with vacuum deposition While making this vapor-deposit so that a material which puts a material and a binder which constitute a particle into a separate crucible, and constitutes a particle may constitute a diameter submicron detailed island The above-mentioned binder is made to vapor-deposit so that between a these island-like particle and island-like particles may be filled, and then a photoresist is applied on these vacuum evaporationo films. With a conventional method What is necessary is to etch, to make the above-mentioned vacuum evaporationo film like pixel Mabe remain selectively, and just to form a light-scattering layer through a photo mask, after developing negatives, exposure and. In addition, also when using other dry processes, such as sputtering, it is possible to form a light-scattering layer by method which applied correspondingly in the case of vacuum deposition.
[0028] In addition, even if it is the case where a light-scattering layer is formed by which method, it is desirable to form

a light-scattering layer with a precision sufficient at least to pixel Mabe, but since a binder is transparent and colorless and a path of a particle is also fully small even if it remains to a pixel part slightly, display light can display a high image of contrast excellent in brightness and color purity, without being scattered about substantially.
[0029] Next, since it was not limited especially when permeability is low and micro processing, such as etching, was easy as a material which constitutes the above-mentioned metal protection-from-light layer in invention concerning claims 1-3, but Cr, aluminum, nickel, etc. could especially be applied and it mentioned above, Cr is desirable. Moreover, 1 micrometer is suitable for the thickness from 200nm, and after it forms membranes to homogeneity, it performs photolithography processing which consists of formation and etching processing of a photoresist and which was mentioned above, and performs the patterning. In addition, if uniform thickness and a uniform presentation are acquired, a membrane formation method of a metal protection-from-light layer is arbitrary, for example, can apply a vacuum deposition method, the sputtering method, etc. the mask which will apply at the time of exposure if a type (P: a positive type, N:negative mold) of a resist an object for light-scattering section formation and for metal protection-from-light stratification makes the same and it excels when invention concerning claim 2 which split-face--ization-processes a transparence substrate front face, and forms the above-mentioned light-scattering section in a part corresponding to a metal protection-from-light layer here is applied -- P and N – a mask is [that what is necessary is just to both prepare] good only at one kind
[0030] Moreover, glass, plastics, etc. are mentioned and, generally, as for a material applicable as the above-mentioned transparence substrate in invention concerning claims 1-3, glass is applied. Moreover, it can form by the method that a method (pigment-content powder method) of carrying out exposure development and forming about the above-mentioned transparence coloring layer after applying a photopolymer and applying a method (staining technique) of dyeing and forming this with a color after carrying out exposure development, and a photopolymer with which a transparence coloring agent was contained, a method (print processes) of printing and forming printing ink containing a transparence coloring agent, etc. are well-known.
[0031] Moreover, in a light filter concerning claims 1-3, a transparent electrode layer which is prepared on the above-mentioned transparence coloring layer, changes orientation of liquid crystal for every pixel, and controls light transmission of a pixel part may be provided. As this transparent electrode layer, a surface-electrical-resistance value can use [light transmittance] the following [50ohms / **] 80% or more, and many ITO (indium tin oxide) thin films specifically produced by vacuum deposition method or the sputtering method are used. Furthermore, a smooth layer or a protective layer which consists of transparence resin between the above-mentioned transparence coloring layer and a transparent electrode layer if needed may be prepared.
[0032] In addition, applicability of color FIRU concerning claims 1-3 is applicable not only to an object for liquid crystal displays illustrated but a light filter for a display of another kind with a natural thing.
[0033]
[Function] Since the light-scattering section is formed in the part corresponding to the metal protection-from-light layer on a transparence substrate according to invention concerning claims 1-3, About the light which penetrates at least pixel Mabe, this can be covered according to an operation of the above-mentioned metal protection-from-light layer. On the other hand, in case this light is reflected in a metal protection-from-light layer about the light which carried out incidence at least to pixel Mabe from the observer side of a display, it becomes possible to be scattered about according to an operation of the above-mentioned light-scattering section, and to reduce that reinforcement.
[0034] Moreover, since the above-mentioned light-scattering section is formed only in the metal protection-from-light layer on a transparence substrate, and the corresponding part and is not formed in an image part, it is different from the advanced technology and the permeability in a pixel part does not fall. Therefore, in spite of forming the light-scattering section, it becomes possible to prevent lowering of the display brightness. Furthermore, when the transparence coloring layer which consists of a photoresist is applied, since the light-scattering section is not formed in the pixel part of a transparence substrate, the adhesion force over the above-mentioned transparence substrate of a photoresist does not increase. Therefore, since the poor development of a greasing does not take place, it becomes possible to also prevent lowering of color purity.
[0035]
[Example] Hereafter, the example of this invention is explained to details with reference to a drawing.
[0036] [Example 1]
(1) All over one side of the glass substrate (Corning, Inc. make #7059) of the 2 inches angle of comparative

experiments of the reflection factor by the existence of the light-scattering section, the spin coat of the photoresist of POJITAIPU was carried out to the thickness of 2 micrometers. After drying this photoresist, the whole glass substrate was immersed in the ammonium fluoride aqueous solution for several minutes, etching processing was carried out and the near whole surface where the above-mentioned photoresist is not applied was split-face-ized. Next, after being immersed in photoresist film exfoliation liquid and exfoliating the above-mentioned photoresist, sputtering membrane formation of the Cr film was carried out all over the side split-face-ized [above] at the thickness of 600nm.
[0037] In this way, the reflection factor of incidence Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. was measured for light on the conditions of five incident angles from the glass substrate side of the glass substrate with which Cr film was formed. The reflection factor made the reflection factor of aluminum itself 100%, and showed it by the percentage to the reflection factor of this aluminum itself.
[0038] For the comparison, Cr film was formed similarly on the glass substrate which has not performed split-face-ized processing, and the reflection factor was measured similarly.
[0039] These results are shown in drawing 7 . Among drawing, when alpha performs split-face-ized processing, beta is the case where it has not given. It has checked that the reflection factor was falling remarkably from these results compared with the case where it has not given when split-face-ized processing is performed.
[0040] (2) The light filter concerning the example of display ****** of a light filter The light-scattering section 2 formed at least in pixel Mabe of a glass substrate 1 and this glass substrate 1 by split-face-ized processing as shown in drawing 1 , The metal protection-from-light layer 3 formed on this light-scattering section 2, and the transparence coloring layers 4R, 4G, and 4B of three colors of R, G, and B which were prepared in the pixel part of the above-mentioned glass substrate 1, The body consists of transparent electrodes 6 by which the laminating was carried out through the smoothing layer 5 on the metal protection-from-light layer 3 and the transparence coloring layers 4, such as this.
[0041] And this light filter is manufactured through the following processes. That is, as shown in drawing 5 A, respectively, the spin coat of the photoresists 11 and 12 of POJITAIPU was carried out to the thickness of 2 micrometers, and both sides of the glass substrate (# by Corning, Inc. 7059) 1 of a 4 inch angle were dried. Next, through the photo mask 13, ultraviolet-rays exposure was carried out, negatives were developed to one photoresist 11, and at least pixel Mabe of a glass substrate 1 was exposed (refer to drawing 5 B).
[0042] In this way, it was immersed in the ammonium fluoride aqueous solution which mentioned above the glass substrate 1 which at least pixel Mabe of one side exposed, and after split-face-izing at least the outcrop by etching and forming the light-scattering section 2 (refer to drawing 5 C), the double-sided photoresists 11 and 12 were exfoliated (refer to drawing 5 D).
[0043] Next, sputtering membrane formation of the Cr film of 600nm of thickness was carried out, and the spin coat of the photoresist of POJITAIPU of 2 micrometers of thickness was carried out to the processing side of the glass substrate 1 with which the light-scattering section 2 was formed at least in pixel Mabe of the one side after that. After drying this resist, with the photo mask applied at the time of formation of the above-mentioned light-scattering section 2, using the reverse type photo mask, ultraviolet-rays exposure was carried out and negatives were developed. Furthermore, this was immersed in the second cerium ammonium aqueous solution of a nitric acid, patterning of Cr film was performed, the above-mentioned resist was exfoliated, and the metal protection-from-light layer 3 was formed (refer to drawing 5 E). Besides, the transparence coloring layers 4R, 4G, and 4B were formed using respectively the color resist by which the pigment of Red, Green, and Blue was distributed, while carrying out the spin coat of the polyimide system smoothing layer 5 of 2 micrometers of thickness further, it heat-hardened, and the transparent electrode 6 which consists of an ITO film by sputtering membrane formation on it was formed, and it asked for the light filter for a display (refer to drawing 1).
[0044] Moreover, for the comparison, as shown in drawing 3 , the glass substrate 1 which has not performed split-face-ized processing was used, the metal protection-from-light layer 3, the transparence coloring layers 4R, 4G, and 4B, the smoothing layer 5, and the transparent electrode 6 were formed similarly, and it asked for the light filter (example of comparison 1A).
[0045] Similarly, as shown in drawing 4 , the glass substrate 1 which split-face--ization-processed the whole one side surface was used, the metal protection-from-light layer 3, the transparence coloring layers 4R, 4G, and 4B, the smoothing layer 5, and the transparent electrode 6 were formed, and it asked for the light filter (example of comparison 1B).

[0046] And the following results were obtained when the display experiment of the light filter concerning the example of a comparison was conducted on the example list. That is, in the light filter concerning example of comparison 1A, since the reflected light from the metal protection-from-light layer 3 of Cr film was strong, color repeatability is large to an angle of visibility, and contrast depended low.
[0047] Compared with the light filter concerning example of comparison 1A, the reflected light from the metal protection-from-light layer 3 is weak, and although the angle-of-visibility dependency of color repeatability is also improved, the greasing to which the transparence coloring layer 4 remains to a pixel part was seen, the light filter applied to example of comparison 1B on the other hand had color purity and low lightness, and contrast was also low [the light filter].
[0048] On the other hand, in the light filter concerning an example, while the reflected light from the metal protection-from-light layer 3 was weak and the angle-of-visibility dependency of color repeatability was also improved again compared with the light filter concerning example of comparison 1A, compared with the light filter concerning example of comparison 1B, the display light which penetrates a pixel part was excellent in color purity and lightness, and it was what can display the image which has very high contrast.
[0049] [Example 2]
(1) After the zirconium oxide particle with a particle size of 1 micrometer carried out polishing processing of the whole one side surface of the glass substrate (Corning, Inc. make #7059) of the 2 inches angle of comparative experiments of the reflection factor by the existence of the light-scattering section with the polishing liquid which consists of the aqueous solution contained 20% of the weight, sputtering membrane formation of the Cr film was carried out in this split-face-ized whole field at the thickness of 600nm.
[0050] In this way, the reflection factor of incidence Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. was measured for light on the conditions of five incident angles from the glass substrate side like [glass substrate / with which Cr film was formed] the example 1. Moreover, the reflection factor made the reflection factor of aluminum itself 100% like the example 1, and showed it by the percentage to the reflection factor of this aluminum itself.
[0051] Moreover, for the comparison, Cr film was formed similarly on the glass substrate which has not performed split-face-ized processing, and the reflection factor was measured similarly.
[0052] This measurement result showed the same inclination as an example 1 (refer to drawing 7), and it has checked that that reflection factor was falling compared with the example of a comparison.
[0053] (2) a display experiment of a light filter -- pass the following processes -- it asked for the same light filter as the example 1 as shown in drawing 1 .
[0054] That is, the spin coat of the photoresist of POJITAIPU of 2 micrometers of thickness was carried out to one side of the glass substrate (Corning, Inc. make #7059) of a 4 inch angle, and it was dried. Next, ultraviolet-rays exposure was carried out using the photo mask the object for metal protection-from-light layers, and reverse type to this field, and negatives were developed. After carrying out polishing processing only of the outcrop by having made this into the mask with the above-mentioned polishing liquid (aqueous solution with which the zirconium oxide particle with a particle size of 1 micrometer was contained 20% of the weight) and forming the light-scattering section, the above-mentioned photoresist was exfoliated.
[0055] It asked for the light filter hereafter applied to this example through the same process as an example 1.
[0056] Moreover, as shown in drawing 4 , while the whole one side surface used the split-face--ization-processed glass substrate 1, formed the metal protection-from-light layer 3, the transparence coloring layers 4R, 4G, and 4B, the smoothing layer 5, and the transparent electrode 6 and manufactured the light filter (example 2 of a comparison) like the example 1 for the comparison, the light filter (refer to drawing 3) concerning example of comparison 1A manufactured in the example 1 was also prepared.
[0057] In addition, in the light filter concerning the example 2 of a comparison, split-face-ized processing of a glass substrate 1 is performed by the grinding method applied in the example 2.
[0058] And the following results were obtained when the display experiment of the light filter concerning the example of a comparison was conducted on example lists, such as this, like the example 1. That is, although the reflected light from the metal protection-from-light film 3 was weak and the angle-of-visibility dependency of color repeatability is also improved compared with the light filter concerning the above-mentioned example of comparison 1A, the greasing to which the transparence coloring layer 4 remains to a pixel part was seen, the light filter concerning the example 2 of a comparison had color purity and low lightness, and its contrast was low.

[0059] On the other hand, while the reflected light from the metal protection-from-light film 3 was weak and the angle-of-visibility dependency of color repeatability was also improved again compared with the light filter applied to example of comparison 1A in the light filter concerning an example 2, even if compared with the light filter concerning the example 2 of a comparison, the display light which penetrates a pixel part was what can display the image which is excellent in color purity and lightness and has very high contrast.
[0060] [Example 3]
(1) Use the air in which the powder emery was contained in the whole one side surface of the glass substrate (Corning, Inc. make #7059) of the 2 inches angle of comparative experiments of the reflection factor by the existence of the light-scattering section, and it is the pneumatic pressure of 5kg/cm2. After carrying out sandblasting and split-face-izing on conditions, sputtering membrane formation of the Cr film was carried out in this split-face-ized whole field at the thickness of 600nm.
[0061] In this way, the reflection factor of incidence Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. was measured for light on the conditions of five incident angles from the glass substrate side like [glass substrate / with which Cr film was formed] the example 1. Moreover, the reflection factor made the reflection factor of aluminum itself 100% like the example 1, and showed it by the percentage to the reflection factor of this aluminum itself.
[0062] Moreover, for the comparison, Cr film was formed similarly on the glass substrate which has not performed split-face-ized processing, and the reflection factor was measured similarly.
[0063] This measurement result showed the same inclination as an example 1 (refer to drawing 7), and it has checked that that reflection factor was falling compared with the example of a comparison.
[0064] (2) a display experiment of a light filter -- pass the following processes -- it asked for the same light filter as the example 1 as shown in drawing 1 .
[0065] That is, the spin coat of the photoresist of POJITAIPU of 2 micrometers of thickness was carried out to one side of the glass substrate (Corning, Inc. make #7059) of a 4 inch angle, and it was dried. Next, ultraviolet-rays exposure was carried out using the photo mask the object for metal protection-from-light layers, and reverse type to this field, and negatives were developed. After carrying out sandblasting processing only of the outcrop with the air in which the powder emery was contained by making this into a mask and forming the light-scattering section, the above-mentioned photoresist was exfoliated.
[0066] It asked for the light filter hereafter applied to this example through the same process as an example 1.
[0067] Moreover, as shown in drawing 4 , while the whole one side surface used the split-face--ization-processed glass substrate 1, formed the metal protection-from-light layer 3, the transparence coloring layers 4R, 4G, and 4B, the smoothing layer 5, and the transparent electrode 6 and manufactured the light filter (example 3 of a comparison) like the example 1 for the comparison, the light filter (refer to drawing 3) concerning example of comparison 1A manufactured in the example 1 was also prepared.
[0068] In addition, in the light filter concerning the example 3 of a comparison, split-face-ized processing of a glass substrate 1 is performed by the sandblasting method applied in the example 2.
[0069] And the following results were obtained when the display experiment of the light filter concerning the example of a comparison was conducted on example lists, such as this, like the example 1. That is, although the reflected light from the metal protection-from-light film 3 was weak and the angle-of-visibility dependency of color repeatability is also improved compared with the light filter concerning the above-mentioned example of comparison 1A, the greasing to which the transparence coloring layer 4 remains to a pixel part was seen, the light filter concerning the example 3 of a comparison had color purity and low lightness, and its contrast was low.
[0070] On the other hand, while the reflected light from the metal protection-from-light film 3 was weak and the angle-of-visibility dependency of color repeatability was also improved again compared with the light filter applied to example of comparison 1A in the light filter concerning an example 3, even if compared with the light filter concerning the example 3 of a comparison, the display light which penetrates a pixel part was what can display the image which is excellent in color purity and lightness and has very high contrast.
[0071] [Example 4]
(1) The polymerization of 80 % of the weight (HEMA) of comparative-experiments 2-hydroxyethyl methacrylate of the reflection factor by the existence of the light-scattering section, 14 % of the weight (MAAm) of methoxymethyl acrylamides, 3 % of the weight (DMAPMA) of dimethylaminopropyl methacrylamide, and the 3 % of the weight of the acrylic acids was carried out, and the aqueous solution which added and asked for 10% of the weight of the diazo resin

for this polymer was used as the photosensitive binder. This photosensitive binder is made to mix and distribute a zirconium oxide particle with a mean particle diameter of 0.5 micrometers by the weight ratio of binder:particle =6:5, all over one side of the glass substrate (Corning, Inc. make #7059) of a 2 inch angle, by 1 micrometer of thickness, the spin coat of the obtained dispersion liquid was carried out, and they were dried. Next, it is this whole surface 100 mJ/cm2 After carrying out ultraviolet-rays exposure on conditions and forming the light-scattering section, sputtering membrane formation of the Cr film was carried out all over this light-scattering section at the thickness of 600nm.
[0072] In this way, the reflection factor of incidence Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. was measured for light on the conditions of five incident angles from the glass substrate side like [glass substrate / with which Cr film was formed] the example 1. Moreover, the reflection factor made the reflection factor of aluminum itself 100% like the example 1, and showed it by the percentage to the reflection factor of this aluminum itself.
[0073] Moreover, for the comparison, Cr film was formed similarly on the glass substrate which has not performed split-face-ized processing, and the reflection factor was measured similarly.
[0074] This measurement result showed the same inclination as an example 1 (refer to drawing 7), and it has checked that that reflection factor was falling compared with the example of a comparison.
[0075] (2) The light filter concerning the example of display ****** of a light filter The light-scattering layer 20 formed at least in pixel Mabe of a glass substrate 1 and this glass substrate 1 as shown in drawing 2 , The metal protection-from-light layer 3 formed in this light-scattering layer 20, and the transparence coloring layers 4R, 4G, and 4B of three colors of R, G, and B which were prepared in the pixel part of the above-mentioned glass substrate 1, The body consists of transparent electrodes 6 by which the laminating was carried out through the smoothing layer 5 on the metal protection-from-light layer 3 and the transparence coloring layers 4, such as this.
[0076] And this light filter is manufactured through the following processes. That is, as shown in drawing 6 A, the spin coat of the above-mentioned dispersion liquid was carried out by the thickness of 1 micrometer all over one side of the glass substrate (# by Corning, Inc. 7059) 1 of a 4 inch angle.
[0077] Next, the mask of the negative pattern of a metal protection-from-light layer is used to this field, and they are 100 mJ/cm2. Ultraviolet-rays exposure was carried out on conditions, and negatives were developed with the acetic acid, and the light-scattering layer 20 was formed at least in pixel Mabe of a glass substrate 1 (refer to drawing 6 B).
[0078] Next, sputtering membrane formation of the Cr film of 600nm of thickness was carried out, and the spin coat of the photoresist of POJITAIPU of 2 micrometers of thickness was carried out to the processing side of a glass substrate 1 in which this light-scattering layer 20 was formed after that. After drying this resist, using the photo mask of the positive pattern of a metal protection-from-light layer, ultraviolet-rays exposure was carried out (refer to drawing 6 C), and negatives were developed.
[0079] Furthermore, this was immersed in the second cerium ammonium aqueous solution of a nitric acid, patterning of Cr film was performed, the above-mentioned resist was exfoliated, and the metal protection-from-light layer 3 was formed (refer to drawing 6 D). Besides, the transparence coloring layers 4R, 4G, and 4B were formed using respectively the color resist by which the pigment of Red, Green, and Blue was distributed, while carrying out the spin coat of the polyimide system smoothing layer 5 of 2 micrometers of thickness further, it heat-hardened, and the transparent electrode 6 which consists of an ITO film by sputtering membrane formation on it was formed, and it asked for the light filter for a display (refer to drawing 2).
[0080] Next, while using the glass substrate with which the light-scattering layer was formed all over one side, forming the metal protection-from-light layer, the transparence coloring layer, the smoothing layer, and the transparent electrode and manufacturing a light filter (example 4 of a comparison) like an example 1 for a comparison, the light filter (refer to drawing 3) concerning example of comparison 1A manufactured in the example 1 was also prepared.
[0081] In addition, in the light filter concerning the example 4 of a comparison, the light-scattering layer of a glass substrate 1 is formed with the application of the dispersion liquid for which mixed the zirconium oxide particle with a mean particle diameter of 0.5 micrometers to the above-mentioned photosensitive binder by the weight ratio of binder:particle =6:5, and it was asked.
[0082] And the following results were obtained when the display experiment of the light filter concerning the example of a comparison was conducted on example lists, such as this, like the example 1. That is, although the reflected light from a metal protection-from-light film was weak and the angle-of-visibility dependency of color repeatability is also improved compared with the light filter concerning the above-mentioned example of comparison 1A, the greasing to which a transparence coloring layer remains to a pixel part was seen, the light filter concerning the example 4 of a

comparison had color purity and low lightness, and its contrast was low.
[0083] On the other hand, while the reflected light from the metal protection-from-light film 3 was weak and the angle-of-visibility dependency of color repeatability was also improved again compared with the light filter applied to example of comparison 1A in the light filter concerning an example 4, even if compared with the light filter concerning the example 4 of a comparison, the display light which penetrates a pixel part was what can display the image which is excellent in color purity and lightness and has very high contrast.
[0084]
[Effect of the Invention] Since the light-scattering section is formed in the part corresponding to the metal protection-from-light layer on a transparence substrate according to invention concerning claims 1-3, About the light which penetrates at least pixel Mabe, this can be covered according to an operation of the above-mentioned metal protection-from-light layer. On the other hand, in case this light is reflected in a metal protection-from-light layer about the light which carried out incidence at least to pixel Mabe from the observer side of a display, it becomes possible to be scattered about according to an operation of the above-mentioned light-scattering section, and to reduce that reinforcement.
[0085] Moreover, since it is formed only in the metal protection-from-light layer on a transparence substrate, and the corresponding part and is not formed in an image part, since it is different from the advanced technology and the permeability in a pixel part does not fall, although the above-mentioned light-scattering section forms the light-scattering section, it becomes possible [preventing lowering of the display brightness].
[0086] Furthermore, when the transparence coloring layer which consists of a photoresist is applied, since the light-scattering section is not formed in the pixel part of a transparence substrate, the adhesion force over the above-mentioned transparence substrate of a photoresist does not increase. For this reason, it becomes possible to also prevent lowering of the color purity accompanied by poor development.
[0087] Therefore, it has the effect that the light transmission which can be set at least to pixel Mabe, and the light filter which decreased the light reflex can be offered, without causing lowering of brightness or color purity.

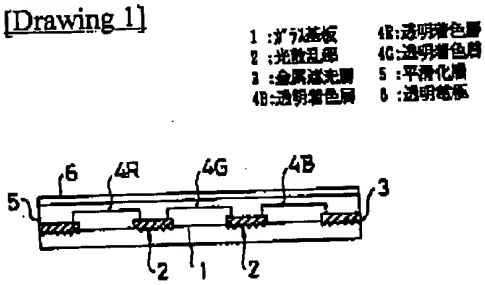
[Translation done.]

* NOTICES *

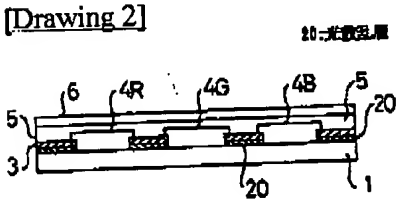
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

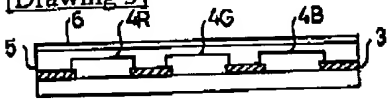
[Drawing 1]



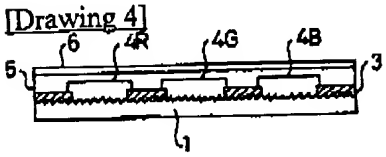
[Drawing 2]



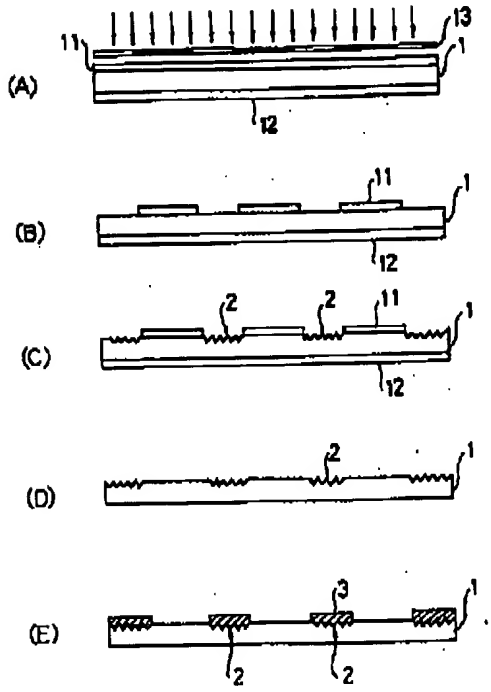
[Drawing 3]



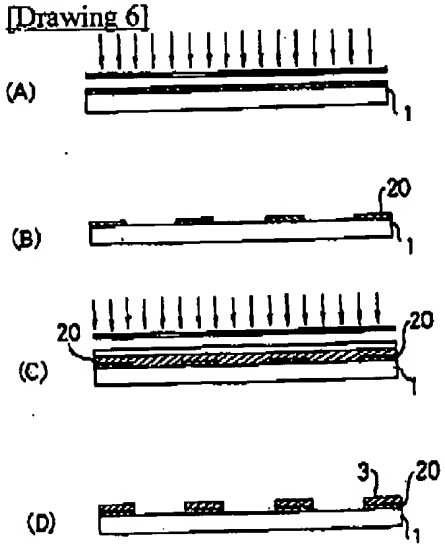
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Drawing 7]